

Science Enabled By A High Altitude Airship (HAA)



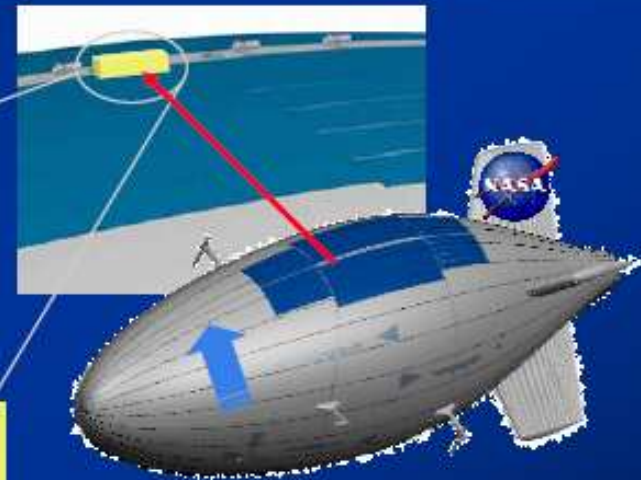
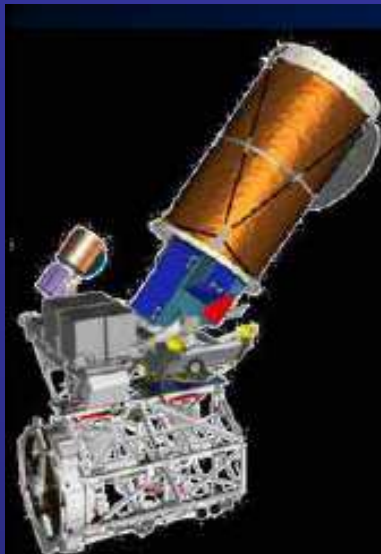
**Julia Saba (LMATC),
Keith Strong (SP Systems),
Joe Davila & Jay Herman (GSFC)**

A Low “Geosynchronous” Autonomous Platform for Science

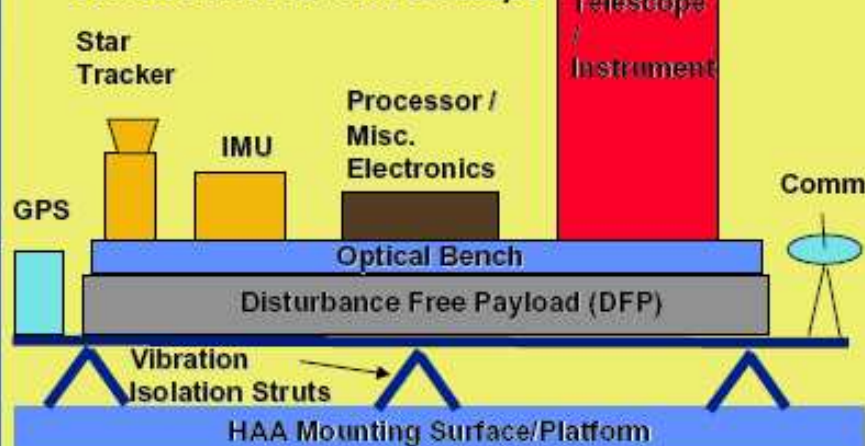
- What science can be done from 18km or higher?
 - *Uniquely*
 - High Spatial Resolution (meters or less, in Earth direction)
 - High Data Rates (i.e., high time resolution)
 - Hover or Track (e.g., storms)
 - *Nearly as well as from space but also.....*
 - More cheaply & longer duration than sounding rockets, airplanes, or UAVs
 - More timely and larger payloads than satellites
 - Longer duration flights than current scientific balloons
 - Can station keep, if desired, via propulsion system.

**HAA offers more frequent and cheaper access to space
and can obtain unique data sets**

Designed to Accommodate Instruments with High-Accuracy Pointing



Observation Platform Concept



Disturbance Free Payload (DFP)
Vibration & Precision Pointing Technology
> 60dB broadband vibration isolation

HAA Programmatic Advantages

- **Potential for world-class science:**
 - Stable geostationary platform w/ tracking capability
 - Enables long-duration missions
 - Large-aperture telescope capability
- **Instrument testbed, with more risk tolerance (cheaper!):**
 - Instruments are recoverable / refurbishable
 - Require less development testing, can be single string
 - Don't need to light-weight or have low power
 - Gentle launch

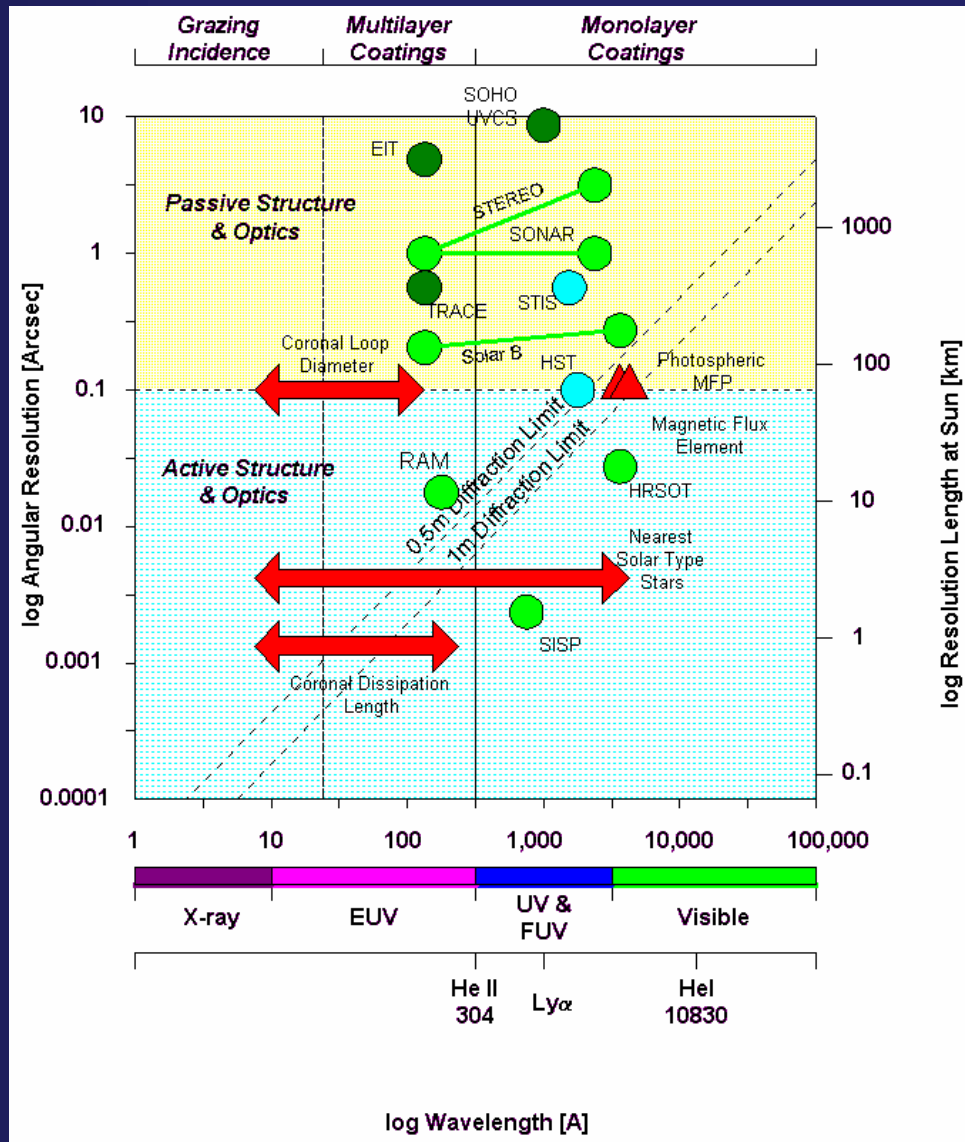
HAA Programmatic Advantages, continued

- **Simultaneous multi-discipline mission capability, Earth-side and top-side (cost sharing)**
- **Rapid response, specialized missions**
- **Absolute calibration underflights for orbital missions**
- **PI training ground for satellite missions**
- **High EPO value (room for small payloads)**
- **Utilizes airfield capability at Wallops or Ames**

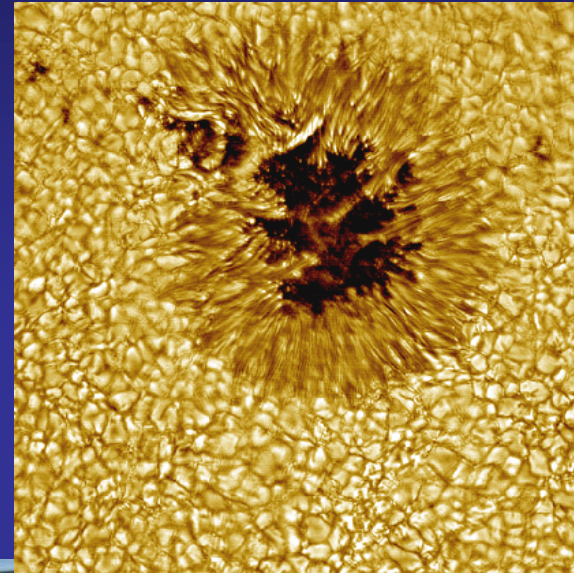
Heliophysics Applications

- Large aperture, stable pointing platform enables high resolution solar observing for $\lambda > 2000 \text{ \AA}$
 - Ultra-high resolution ($<0.1 \text{ arcsec}$) optical imaging of the photosphere and chromosphere (above most of the atmosphere)
 - High-resolution Solar Coronagraph to look at streamers, CME's, solar wind acceleration, etc.
 - Absolute TSI measurement with on-orbit calibration
 - IR magnetograph
 - Auroral Imaging
 - Limb sounding
 -?

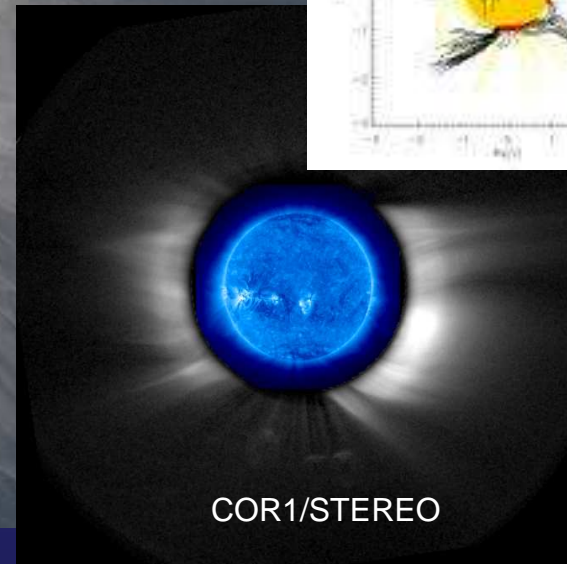
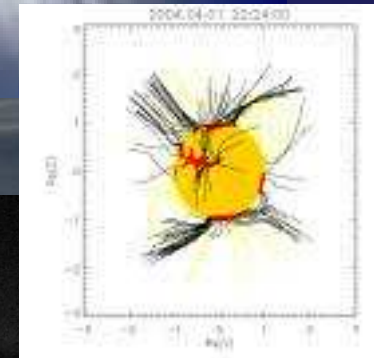
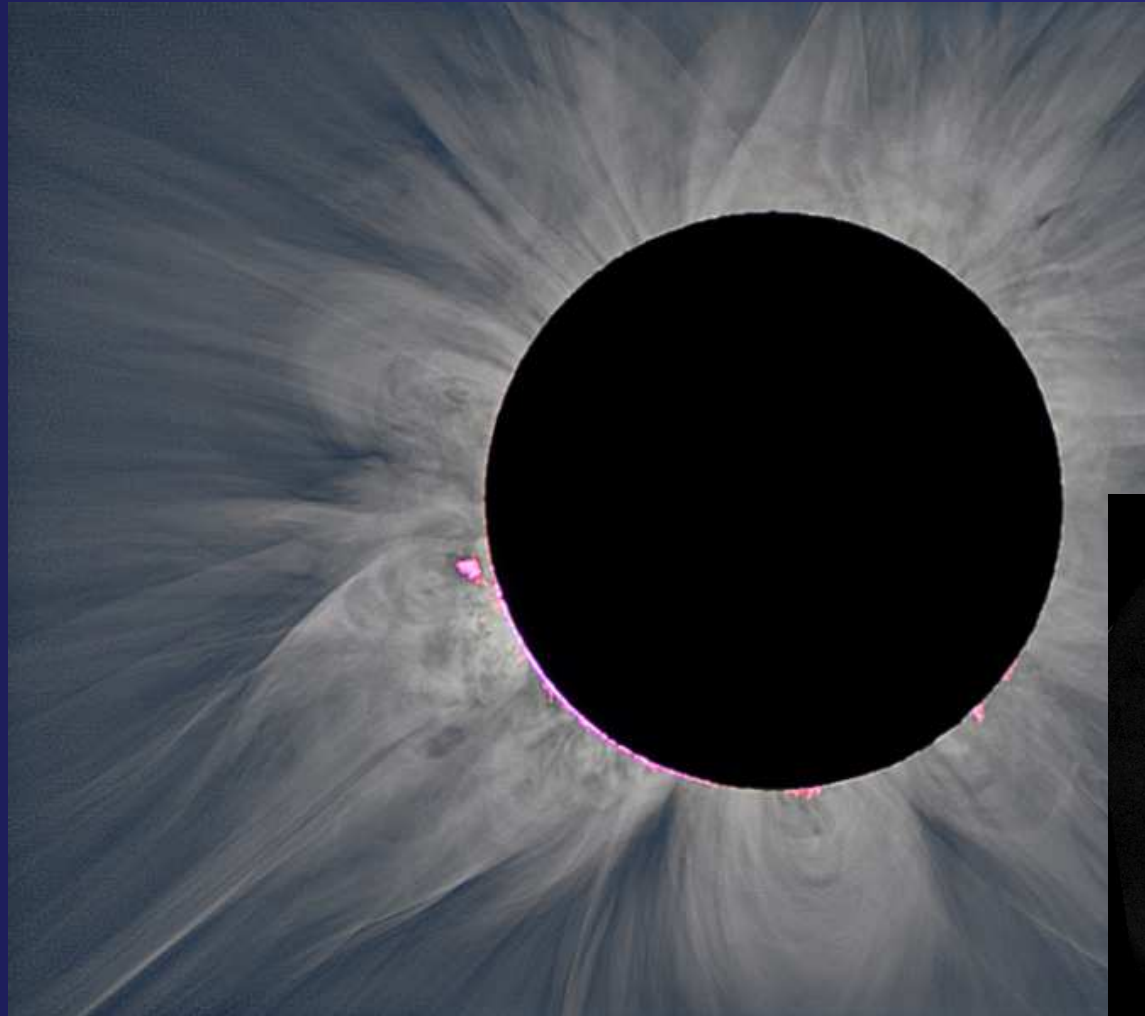
High Resolution Imaging of the Photosphere



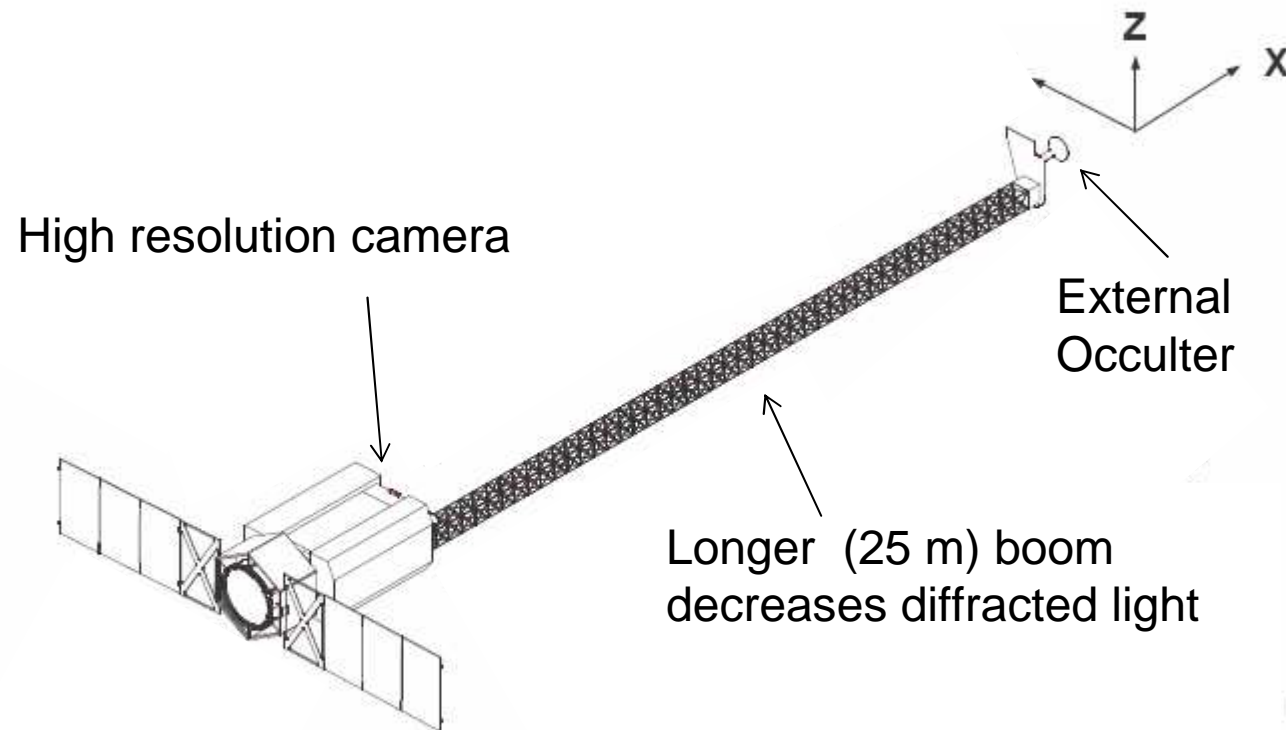
log Resolution Length at Sun [km]



High Resolution Coronal Imaging



ADVANCED CORONAGRAPH DESIGN



Earth Science Applications

- High-resolution spectral, spatial, temporal Earth imaging
- Hover capability is better than geosync
- Maneuvering available for tracking and mapping
 - Measure Tropospheric wind speed
 - Track storm development (e.g., hurricanes)
 - Column temperature & moisture content (IR sounder)
 - Monitor Pollution plumes (NO₂, SO₂, O₃)
 - Map Ocean color, Sea Surface Temperature
 - Characterize Coastal water (e.g., Chesapeake Bay)
 - Characterize and monitor Ice Sheets
 - Ground-truth absolute calibration of satellite data
 -?

Earth Science Applications



Landsat Image scaled to high altitude balloon view. Spectral imaging at this (30 meters) or higher resolution (3 meters) will reveal tidal processes without time aliasing, and the link with air and land pollution in a manner not previously possible.

Astrophysical Observations

- **Large lift capacity enables large aperture telescopes & interferometers**
 - Optical & IR Telescope
 - Long-duration observations
 - High-Energy supernova observations
 - Fast response and repeatable
 - Comet & Asteroid Encounters
 - Fast response time
 -?

System Requirements

- 60K ft altitude
- Stable fine pointing (sub-arcsec)
- Long-duration (months)
- 500 kg instrument capability
- 1 kW power (tradable for more lift capacity?)
- Station-keeping or maneuverability, depending on mission requirements
- Top- and bottom-mounted instrument capability

Discussion

- **Need to initiate a study to address the following issues :**
 - Identify unique science opportunities
 - Conduct trade of Power system requirement scalability / increased Payload capability
 - Understand operations at Wallops, Glenn, and/or Ames
 - Investigate cost sharing with other Government Agencies